INTERNATIONAL STANDARD

ISO 128-21

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1997-03-01

Technical drawings — General principles of presentation —

Part 21: Preparation of lines by CAD systems

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Dessins techniques — Principes généraux de représentation —

Partie 21: Préparation des traits par systèmes de CAO

Reference number
ISO 128-21:1997(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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International Standard ISO 128-21 was prepared by Technical Committee ISO/TC 10, *Technical drawings, product definition and related documentation*, Subcommittee SC 1, *Basic conventions*.

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ISO 128 consists of the following parts, under the general title *Technical drawings — General principles of presentation*:

— *Part 20: Basic conventions for lines*

— *Part 21: Preparation of lines by CAD systems*

— *Part 23: Lines on construction drawings*

Further parts of ISO 128 are planned, covering other general principles of presentation including those for the application of lines within drawings of various technical fields.

Annex A of this part of ISO 128 is for information only.

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Introduction

Today the appearance of non-continuous lines on technical drawings prepared by computer-aided design (CAD) systems varies considerably between different systems. For that reason the standardized rules established by this International Standard, in addition to those in ISO 128-20, are intended as an aid for the consistent appearance of line elements calculated by computers and drawn by plotters.

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Technical drawings — General principles of presentation —

Part 21:
Preparation of lines by CAD systems

1 Scope

This part of ISO 128 specifies procedures for the calculation of the most important basic types of non-continuous lines according to ISO 128-20 and their line elements.

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2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 128. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 128 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 128-20:1996, *Technical drawings — General principles of presentation — Part 20: Basic conventions for lines.*

ISO 5455:1979, *Technical drawings — Scales.*

3 Definitions

For the purposes of this part of ISO 128 the definitions given in ISO 128-20 apply.

4 Calculation of line elements

4.1 Line type No. 02 (dashed line)

See figure 1 for the configuration of this type of line.

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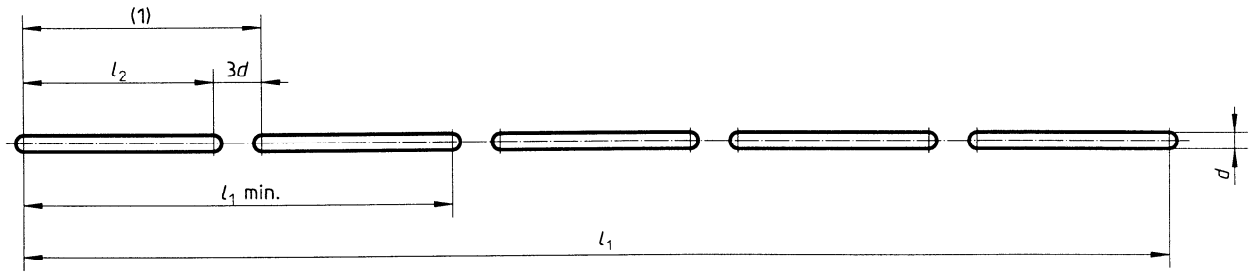

(1): Line segment

Figure 1

EXAMPLE

See figure 2.

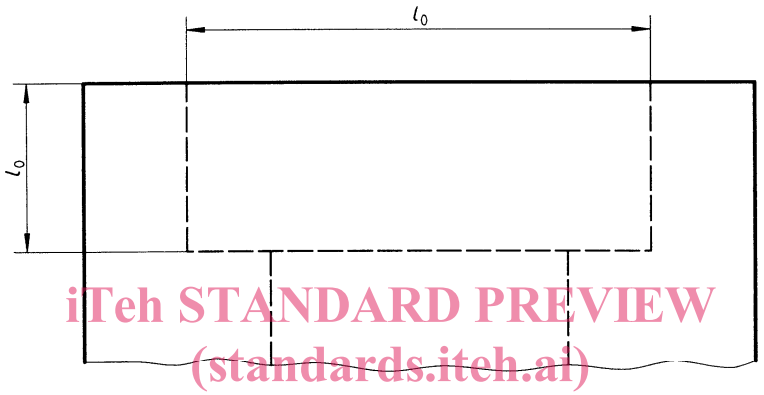

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Figure 2

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Formulae:

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line: $n = \dfrac{l_1 - 12d}{15d}$ (rounded)

c) Length of the dashes: $l_2 = \dfrac{l_1 - 3dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = l_{0\min} = 27d$
(2 dashes 12d, 1 gap 3d)

If dashed lines with a length less than $l_1 = 27d$, have to be drawn, a larger scale from ISO 5455 shall be used (i.e. the elements are drawn at a larger scale).

This line may be drawn with a constant length of dashes (12d). In this case one end of the line may be a shorter or longer dash.

EXAMPLE

$l_1 = 125$ $\quad$ $d = 0{,}35$

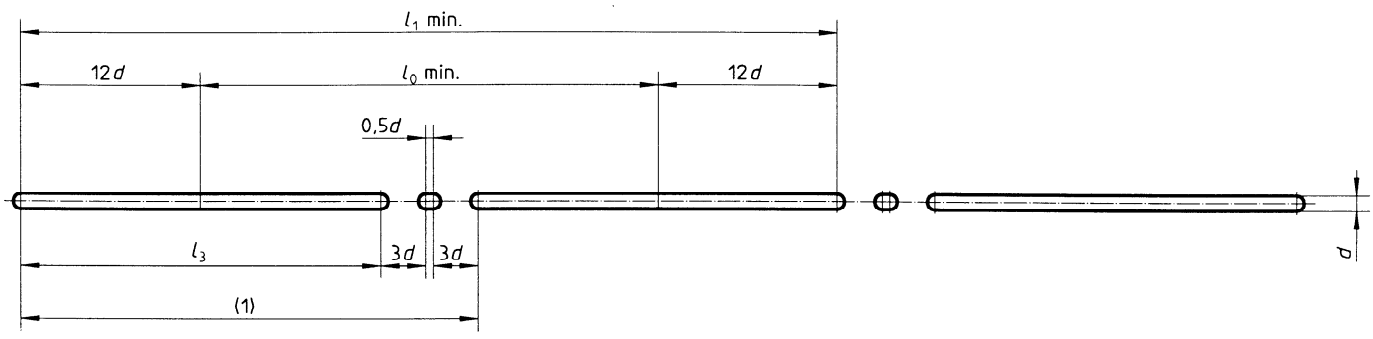
$$n = \frac{125 - 4{,}2}{5{,}25} \triangleq \underline{23{,}01} = \underline{23}$$

$$l_2 = \frac{125 - 24{,}15}{24} = \underline{4{,}202}$$

Interpretation of the result: A dashed line, of length 125 mm and line width 0,35 mm, consists of 23 line segments of length 5,252 mm (4,202 mm + 1,050 mm) and one dash of length 4,202 mm

4.2 Line type No. 04 (long dashed dotted line)

See figure 3 for the configuration of this type of line.



(1): Line segment

Figure 3

EXAMPLE

See figure 4.

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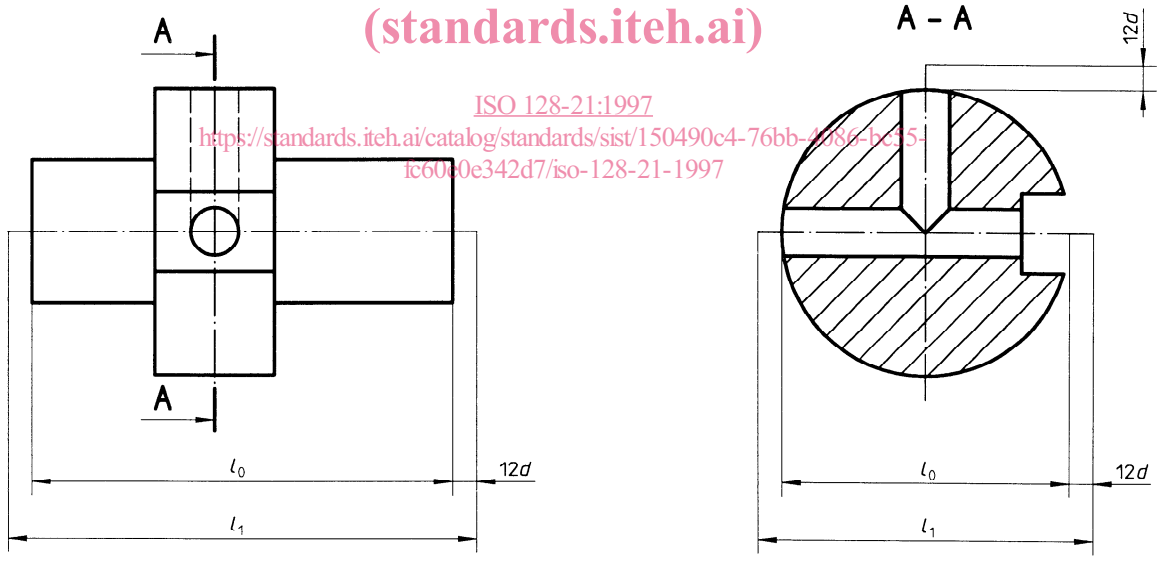

Figure 4

Formulae:

a) Length of the line: $l_1 = l_0 + 24d$
(line extended over the outlines at both sides)

b) Number of line segments within the line: $n = \dfrac{l_1 - 24d}{30{,}5d}$ (rounded)

c) Length of the long dashes: $l_3 = \dfrac{l_1 - 6{,}5dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = 54{,}5d$

Lines shorter than $l_1 = 54{,}5d$ shall be drawn as continuous narrow lines. In order to comply with the requirements of ISO 128-20:1996, clause 5, the length of the long dashes of this line may be decreased or increased.

EXAMPLE

$l_0 = 125$ $d = 0{,}25$

$l_1 = 125 + 6 = \underline{131}$

$$n = \frac{131 - 6}{7{,}625} = \underline{16{,}393} \mathrel{\hat{=}} \underline{16}$$

$$l_3 = \frac{131 - 26{,}00}{17} = \underline{6{,}176}$$

Interpretation of the result: A long dashed dotted line of length 131 mm and line width 0,25 mm, consists of 16 line segments of length 7,801 mm (6,176 mm + 0,750 mm + 0,125 mm + 0,750 mm) and 1 long dash of length 6,176 mm.

4.3 Line type No. 05 (long dashed double-dotted line)

See figure 5 for the configuration of this type of line.

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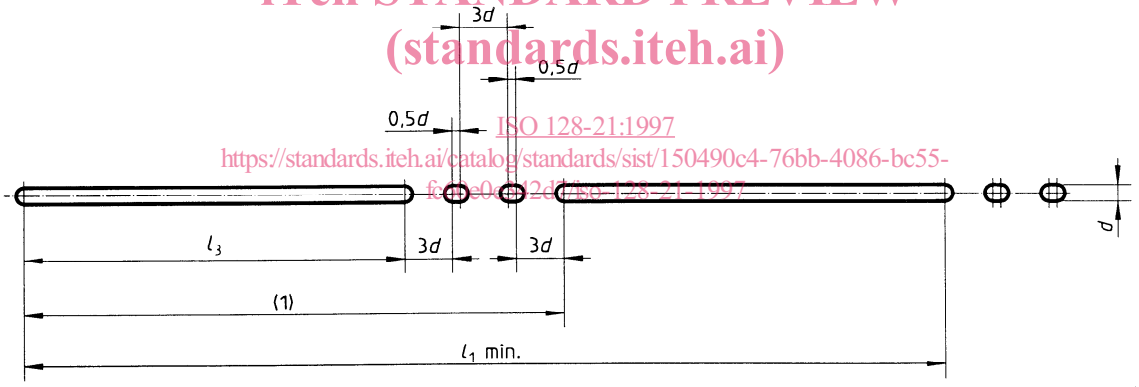

(1): Line segment

Figure 5

EXAMPLE

See figure 6.

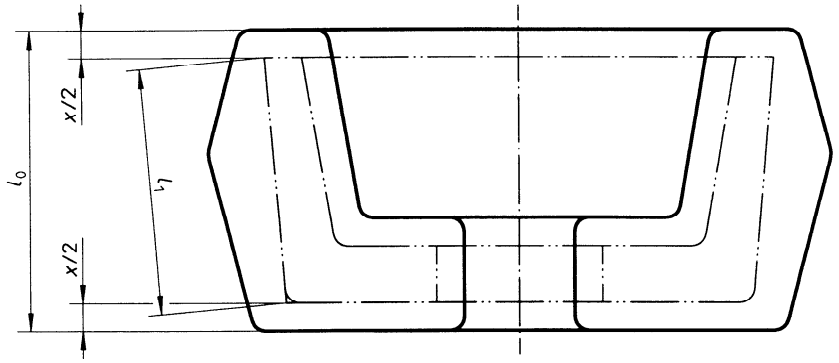

Figure 6

Formulae:

a) Length of the line: $l_1 = l_0 - x$

b) Number of line segments within the line: $n = \frac{l_1 - 24d}{34d}$ (rounded)

c) Length of the long dashes: $l_3 = \frac{l_1 - 10dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = 58d$

Lines shorter than $l_1 = 58d$ shall be drawn at a larger scale, in accordance with ISO 5455.

It is permissible to draw the long dashes with a change in direction, see figure 7.

Figure 7

In order to comply with the requirements of ISO 128-20:1996, clause 5, the length of the long dashes of this line may be increased or decreased.

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EXAMPLE

$l_0 = 128$ $d = 0{,}35$ $\frac{x}{2} = 1{,}5$

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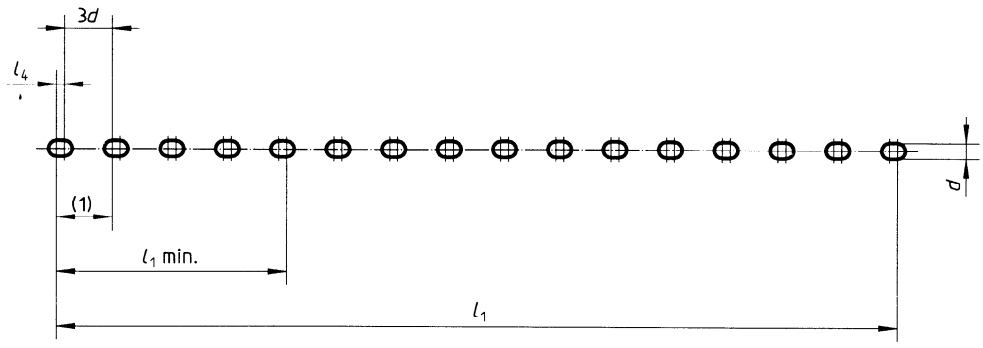
$l_1 = 128 - 3 = \underline{125}$

$n = \frac{125 - 8{,}4}{11{,}9} = \underline{9{,}798} \,\widehat{=}\, \underline{10}$

$l_3 = \frac{125 - 35{,}00}{11} = \underline{8{,}182}$

4.4 Line type No. 07 (dotted line)

See figure 8 for the configuration of this type of line.



(1): Line segment

Figure 8

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EXAMPLE

See figure 9.

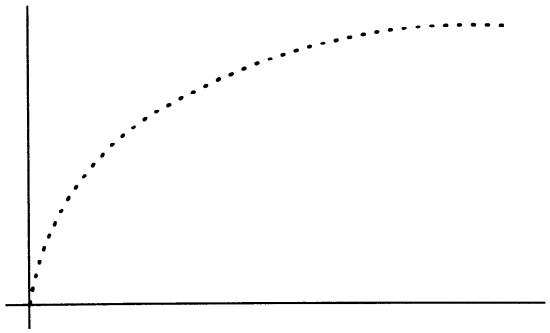

Figure 9

Formulae:

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line: $n = \dfrac{l_1 - 0{,}5d}{3{,}5d}$ (rounded)

c) Length of the dots: $l_4 = \dfrac{l_1 - 3dn}{n+1}$

d) Minimum length of this line: $l_{1\min} = 7{,}5d$

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EXAMPLE

$l_1 = 125$ $\quad d = 0{,}5$

$$n = \frac{125 - 0{,}25}{1{,}75} = \underline{71{,}286} \mathrel{\hat{=}} \underline{71}$$

$$l_4 = \frac{125 - 106{,}5}{72} = \underline{0{,}257}$$

4.5 Line type No. 08 (long dashed short dashed line)

The conditions for this line type are the same as those for type No. 04 but the formulae are slightly modified as follows.

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line: $n = \dfrac{l_1 - 24d}{32d}$ (rounded)

c) Length of the long dashes: $l_3 = \dfrac{l_1 - 12dn}{n+1}$

Lengths of the short dashes: $6d$ (see table 3 of ISO 128-20:1996)

d) Minimum length of this line: $l_{1\min} = 60d$

EXAMPLE

$l_1 = 125$ $d = 0,5$

$$n = \frac{125 - 12}{16} = \underline{7,063} \mathrel{\hat{=}} \underline{7}$$

$$l_3 = \frac{125 - 42}{8} = \underline{10,375}$$

4.6 Line type No. 09 (long dashed double-short dashed line)

The conditions for this line type are similar to those for type No. 05 and the formulae b), c) and d) are slightly modified as follows:

a) Length of the line: $l_1 = l_0$

b) Number of line segments within the line: $n = \frac{l_1 - 24d}{45d}$ (rounded)

c) Length of the long dashes: $l_3 = \frac{l_1 - 21dn}{n + 1}$

Length of the short dashes: $6d$ (see table 3 of ISO 128-20:1996)

d) Minimum length of this line: $l_{1\,min} = 69d$

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EXAMPLE

$l_1 = 125$ $d = 0,25$

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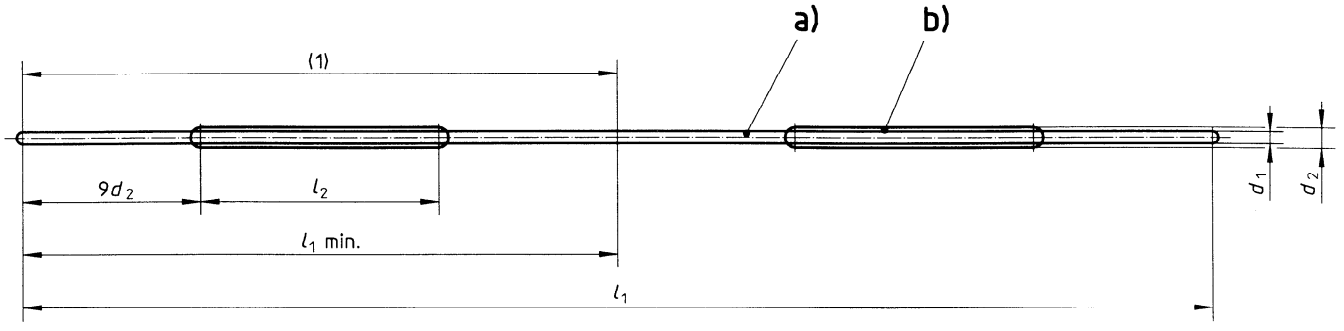
$$n = \frac{125 - 6}{11,25} = \underline{10,578} \mathrel{\hat{=}} \underline{11}$$

$$l_3 = \frac{125 - 57,75}{12} = \underline{5,604}$$

4.7 Examples of combinations of basic types of line

4.7.1 Two types of lines superimposed

See figure 10 for the configuration of this type of line.



(1): Line segment
a): Continuous line No. 01: line width, e.g. 0,25 mm
b): Dashed spaced line No. 03: line width, e.g. 0,5 mm

Figure 10